



10/500813
Rec'd CT/PTO 07 JUL 2004

#2



INVESTOR IN PEOPLE

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

The Patent Office

Concept House

Cardiff Road 07 MAR 2003

Newport
South Wales

WIPO

PCT

NP10 8QQ

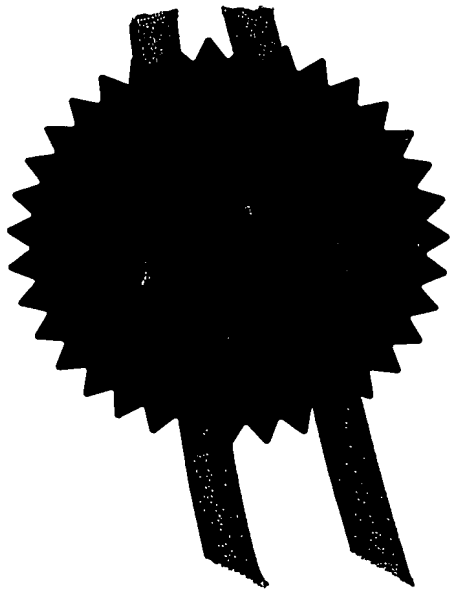
PCT/GB 2002 / 0 0 5 9 3 7

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed

AmBrewster

Dated 24 January 2003

BEST AVAILABLE COPY

Patents Form 1/77

Patents Act 1977
(Rule 16)

THE PATENT OFFICE

- 9 JAN 2002

The Patent Office

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

09 JAN 2002

1. Your reference

IP/P2995

09JAN02 E686452-1 002776

2. Patent application number

(The Patent Office will fill in this part).

0200369.7

~~F01/7750 0-00-0200369.7~~

3. Full name, address and postcode of the or of

QINETIQ LIMITED

each applicant (underline all surnames)

Registered Office 85 Buckingham Gate
London SW1E 6PD

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

GB

8183857001

4. Title of the invention

MINEPLOUGH

5. Name of your agent (if you have one)

Bowdery Anthony Oliver

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

QINETIQ LIMITED
IP Formalities
A4 Bldg
Cody Technology Park
Ively Road
Farnborough

Hants GU14 0LX United Kingdom

6935910005

Patents ADP number (if you know it)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number or earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

Continuation sheets of this form

Description 6

Claim(s) 2

Abstract 1

Drawing(s) 3

28

10. If you are also filing any of the following, state how many against each item.

Priority documents 0

Translations of priority documents 0

Statement of inventorship and right to grant of a patent (Patents Form 7/77) 1

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77) 0

Any other documents 0
(please specify)

11. I / We request the grant of a patent on the basis of this application.

Signature

C M J

Date

3rd January 2002

12. Name and daytime telephone number of person to contact in the United Kingdom MRS S CHARLES 01252 392710

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent of the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or have any questions, please contact the Patent Office on 0645 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have attached 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

Mineplough

The present invention relates to a novel form of blade for a mineplough.

A mineplough may be defined as the apparatus fitted to a (preferably robust) vehicle so as to create a system for effecting clearance of a path through a minefield. In particular this mode of mine clearance is appropriate for use in a wartime situation where a rapid clearance of anti-tank mines is operationally vital because it is recognised that, in these circumstances, some damage is likely to be sustained by at least the mineplough part of the system.

The main mechanical components of a mineplough are:

- i) a blade which comprises:
 - a) tines which are teeth mounted on the blade and which cut into the ground so as to lift the earth and any buried mines; and
 - b) the mouldboard which is the part of the blade that pushes the lifted earth and mines to the side of the vehicle path to clear a lane for following traffic;
- ii) a linkage system which is the mechanism connecting the plough to the carrier vehicle; and
- iii) a depth control system, the function of which is to try and ensure that the tines maintain a constant depth of cut. It usually comprises ground following skids which react against the vertical forces produced during ploughing.

In clearing a path through a major minefield it is recognised that upto 5 mines in total may have to be cleared and if, for example, these are fitted with anti-disturbance fuzing, this may mean upto 5 mines exploding during the clearing operation. To achieve a speedy clearance it is desirable that only one mineplough be actually involved in the operation but with current designs of mineplough it is not possible to attain the level of robustness which is required to achieve this.

It is therefore a primary objective of the invention to provide a mineplough which is sufficiently robust to withstand the blast from one or more typical anti-tank mines and yet continue to operate fully effectively.

The particular areas of weakness of current designs lie in the blade itself and most particularly in the linkage between the blade and the carrier vehicle. Accordingly the present invention seeks to provide a mineplough having both a blade and a linkage system which are more resilient towards high shock loadings that can be created by a mine exploding against any part of the mineplough. The invention therefore provides a mineplough which comprises at least one blade element which is set at an angle to the general direction of movement of the plough so as to deflect lifted earth to one or both sides of the plough, tines attached to each said blade element so as to lift earth ahead of that blade element in the direction of travel thereof, depth control means for controlling the depth of cut of the tines and at least two linkages for connecting the mineplough to a suitable carrier vehicle therefor, characterised in that each blade element is comprised of a plurality of intersecting plates whose planes lie substantially parallel to the said direction of travel and which define open channels therebetween and further characterised in that the linkages each contain at least one crushable element capable of absorbing blast shock.

By providing a generally open structure to the mouldboard, the soil and other blast products which are thrown up by a mine exploding ahead of or on contact with a tine are vented through the blade to a high degree thus lowering the loading on the connecting linkage in particular. Further by providing a structure with considerable depth perpendicular to the blade face, the blade is extremely strong and this, coupled with the relatively small surface area which is presented to blast products by the edges of the intersecting plates, means that the blade structure is highly resistant to damage. Typically the depth of the blade in the direction of its travel will be of the order of 150 mm.

The blade channels defined by the intersecting plates should be relatively narrow such that in operation the channels will tend to clog up with soil and hence ploughing action will be maintained. In any event the channels should be of such dimensions as to ensure that any anti-tank mine will be unable to pass through the

blade. Advantageously, however, the vented blade structure is faced on its front surface with a relatively weak covering plate which will act as a normal mouldboard during ploughing but at the same time is able to absorb some of the blast effect should a mine explode adjacent to the blade. The covering plate should be designed though to fail, at least locally, without causing sufficient resistance to the blast so as to allow damage to be caused elsewhere in the system (and particularly to the linkage).

Although even a first blast may thus cause a substantial disruption to the covering plate (mouldboard) this is likely only to be within an area adjacent to the seat of the explosion and the protective effect of the plate is unlikely to be totally lost even after a number of mines have exploded. Apart from that, as mentioned earlier, even where some of the blade channels through the blade structure have become exposed through degradation of the covering plate, it is likely that, in operation, they will block up with soil and thus a degree of blast resistance will remain even with those channels (as well of course for those areas of the blade which remain protected by undamaged portions of the covering plate).

Advantageously, the structure of the blade comprises a plurality of plates disposed in a substantially vertical arrangement and a further set of plates intersecting these and arranged in a substantially horizontal manner. The spacing of the plates in both dimensions should be such as to ensure that no mine which is likely to be encountered will pass through any of the channels defined by the sets of plates and also such as to ensure that the blade has a sufficient overall strength, while being at the same time sufficiently far apart that the blast venting effect of the blade structure of the invention is maintained. When the plates are arranged in this manner a further advantage of the blade structure of this invention can be achieved by arranging that the tines are formed by an extension of the vertical plates of the blade structure and are thus integral with the rest of the blade. This gives the tines additional strength and resistance to disruption.

The two sets of intersecting plates described above may conveniently each have co-operating slots provided in them so that, to assemble a blade element, the respective plates are simply slid together to interlock. The plates are then welded together along the length of each intersection using a large section fillet weld (typically 20mm).

The mineplough may comprise either a single angled blade element or may comprise two blade elements forming a V-shaped blade overall, depending on the size of clearance path required, the nature and effective power of the carrying vehicle used, the nature of the terrain etc.

The linkage of the mineplough of this invention has a crushable element which acts to absorb some of the forces which would otherwise be transmitted from the blade through the linkage to the carrier vehicle and which could otherwise cause the linkage to fail. In particular the pins (termed the "boom arm pins") which allow for motion of the blade at an angle to the direction of travel are likely to suffer from high levels of stress if the blade is subject to a mine exploding at close range and this could cause the pins to fail in shear.

The crushable element suitably comprises a series of substantially U-shaped channel members located ahead of the boom arm pins in the direction of travel of the blade (ie. between the blade and the boom arm pins which the members are intended to protect). The channel members are designed to crush under a loading which is below the shear strength of the boom arm pins. For additional resilience and to achieve better lateral stability of the blade, two sets of channel members could be provided, one of which sets is positioned vertically and the other set of channel members positioned horizontally with respect to the blade. In an alternative arrangement, the channel members could be replaced with a series of short tubes designed to crumple under a shock load and so to act as energy absorbers and it will be readily apparent to the skilled addressee that other means of providing the desired resilience in the linkage system can be contemplated and are to be understood as falling within the scope of the invention.

The invention will now be further described with reference to the accompanying drawings in which:

Figure 1 is a three dimensional view of a single angled mineplough blade according to the invention;

Figure 2 is a similar view of the same blade as shown in Figure 1, but having a covering plate (mouldboard) attached; and

Figure 3 is a plan view of the same blade as shown in Figure 1 looking from the underside of the blade and showing in more detail a part of the linkage to the carrier vehicle.

In Figure 1 there is shown a mineplough 1 which comprises a set of 9 vertical plates (2a to 2j) and a further set of four horizontally-disposed plates (3a – 3d) constituting the mouldboard. It can be seen that all but one of the vertical plates are extended downwards and forwards of the blade to form a series of tines, 5b – 5j. The plates are conveniently made from steel, for example, Rolled Quenched Tempered (RQT) 701 (a product of Corus Ltd) or a Rolled Homogeneous Armour material. In the case of RQT701 a suitable thickness will be of the order of 20mm for the horizontal plates and 25mm for the vertical plates. Three connecting members 6a, 6b, 6c are attached generally at the rear of the blade for connecting it to the linkage (not shown). (It will be noted that the horizontal plates to which these connecting members are attached are extended outwards towards the connecting members in order to strengthen the plates in the area where the two are connected). A U-shaped channel member 8 is shown generally associated with the connecting member 6c.

In Figure 2 there is shown the same blade as in Figure 1 except that the front face of the blade is now covered with a thin facing plate 7. This plate may be made from steel of 4mm thickness or may comprise a plate of 5 or 10mm thickness of high density polyethylene but it will be readily appreciated that the materials to be used will be dependent to some degree on the size of the openings in the blade structure and on the strength of the linkages among other factors.

Figure 3 shows in greater detail the linkage arrangements of the blade shown in Figures 1 and 2 and the same parts are identified by use of the same numerals as for those Figures. In this drawing the lower ends of vertically-disposed U-shaped channel members 8 associated with both of the connecting members 6b and 6c are shown. Each channel member comprises two channel pieces, 8a and 8b, of which one is housed within the other and provides support once the outer pieces have distorted under a shock load. In this way the channel members can successfully absorb the

blast energy from two mines exploding against the blade and protect the linkages from damage.

Claims

1. A mineplough which comprises at least one blade element which is set at an angle to the general direction of movement of the plough so as to deflect lifted earth to one or both sides of the plough, each said blade element having tines arranged so as to lift earth ahead of that blade element in the direction of travel thereof, depth control means for controlling the depth of cut of the tines and at least two linkages to connect the mineplough to a suitable carrier vehicle therefor, characterised in that each blade element is comprised of a number of intersecting plates whose planes lie substantially parallel to the said direction of travel and which define open channels therebetween and further characterised in that each of the linkages contains at least one crushable element capable of absorbing blast energy.
2. A mineplough as claimed in claim 1 wherein the intersecting plates comprise a first set of plates arranged substantially in the vertical plane and a second set of plates arranged substantially at right angles to the first set.
3. A mineplough as claimed in claim 1 or claim 2 wherein the open channels between the plates are of smaller dimension than any mine which the plough is intended to clear.
4. A mineplough as claimed in any of claims 1 to 3 wherein the open channels have a minimum dimension of the order of 150mm.
5. A mineplough as claimed in any of claims 1 to 4 wherein the front face of the blade is covered with a relatively weak material.
6. A mineplough as claimed in claim 5 wherein the relatively weak material is comprised of a thin sheet of metal or plastics material.
7. A mineplough as claimed in claim 2 or in any of claims 3 to 6 when dependent on claim 2, wherein the vertically-disposed plates are extended generally downwards and forwards of the blade to form the tines.

8. A mineplough as claimed in any preceeding claim wherein the at least one crushable element comprises a substantially U-shaped channel member associated with each linkage and arranged so as to absorb any shock transmitted to it by at least partially collapsing.

9. A mineplough as claimed in claim 8 wherein the channel member comprises two separate U-shaped channel pieces arranged such that one lies within the other and becomes effective to absorb shock only once the outer piece has been deformed.

10. A mineplough substantially as herein described and with reference to the accompanying drawings.

Abstract

A mineplough which is designed to be resilient to exploding mines comprises one or more blades set at an angle to the general direction of movement of the plough so as to deflect lifted earth to one or both sides of the plough and having tines arranged so as to lift earth ahead of the blade in the direction of travel thereof, depth control means for controlling the depth of cut of the tines and at least two linkages to connect the blade to a suitable carrier vehicle for the mineplough. The blade is comprised of a number of intersecting strong metal plates whose planes lie substantially parallel to the direction of travel of the mineplough and which define relatively narrow open channels therebetween so as to allow venting of any explosion caused by a mine exploding in contact with the blade. The blade may be faced with a relatively thin metal or plastics sheet to absorb some of the force of any explosion and further protection is provided by the fact that each linkage contains at least one crushable element capable of absorbing blast energy.

Fig 1

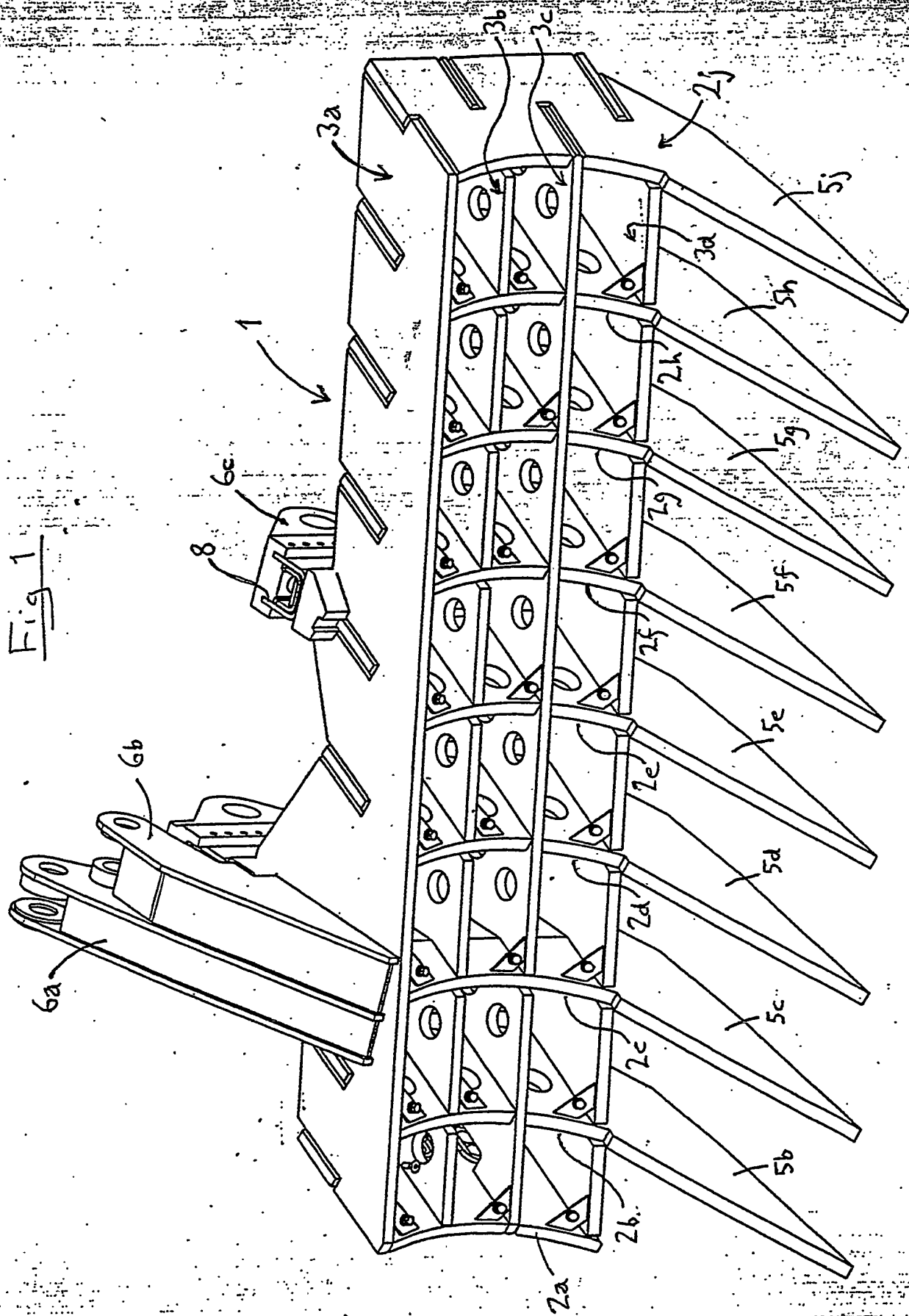


Fig 2

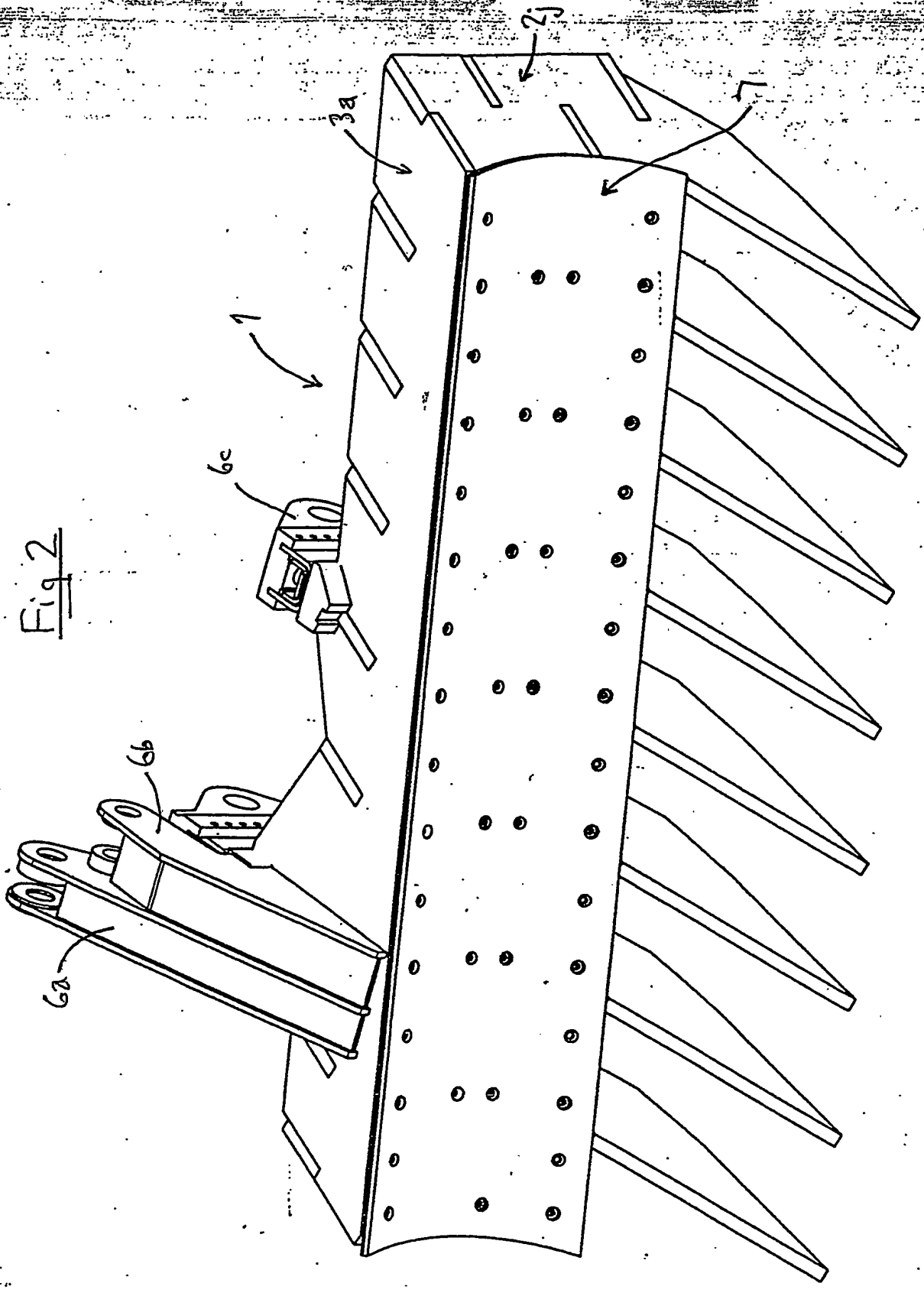
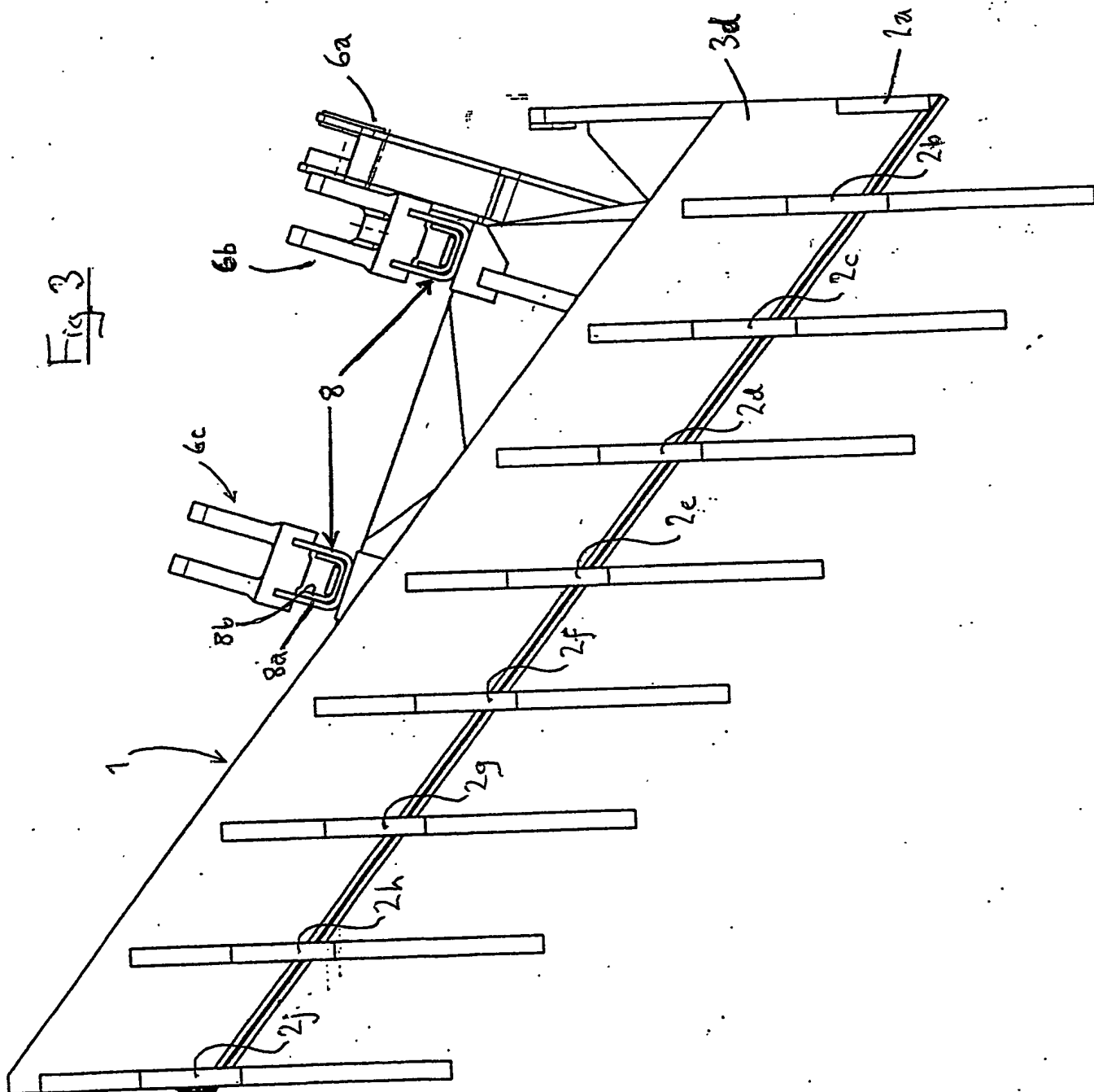


Fig 3



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.